

Application for Letters Patent  
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For:

**PLEAT OR CORRUGATION OF A BELLOWS OF A CONNECTION BETWEEN TWO  
HINGE-LINKED VEHICLES OR VEHICLE SECTIONS E.G., OF AN  
ARTICULATED BUS**

**CROSS-REFERENCE TO RELATED APPLICATIONS**

This application claims Priority from German Application No.  
DE 102 38 673.0-21 filed on August 23, 2002

**1. Field of the Invention.**

The present invention relates to a pleat or corrugation of a bellows of a connection between two hinge-linked vehicles or vehicle sections e.g., of an articulated bus.

**5 2. Description of the Prior Art.**

Expansion or concertina bellows are known. They are part of a connection between two hinge-linked vehicles e.g., an articulated bus, and surround the intercar gangway and the articulation like a sleeve with an approximately rectangular cross section so as to allow passengers to cross from one vehicle section to the other without being exposed to weather conditions.

Moreover, what are termed low floor vehicles are known. Such type low floor vehicles are characterized in that they have very low ground clearance. Low floor vehicles permit the possibility of level boarding, which is particularly advantageous for wheel-chair users. One problem with these articulated vehicles, more specifically busses, is the low ground clearance. In order to prevent the bellows from brushing along the road when driving over a hilltop or through a depression it is known to reduce the height of the pleats in the bottom region. To reduce the height of the pleat naturally involves the reduction of the maximum expansion when such an articulated vehicle provided with a bellows is threading a curve. However, the expansion width is not only reduced by reducing the height of the pleats or corrugations in the bottom region, but also by the fact that the very corner radius of the bellows already suffices to reduce the expansion. This is to say that two factors come together; on the one side the fact that, due to the corner configuration of the bellows, but a reduced expansion is possible, on the other side that, more specifically with low floor vehicles, the height of the pleats or corrugations in the transition zone, meaning in the transition zone between the side wall and the bottom or the ceiling, i.e., in the corner zone, is also reduced. These two factors together reduce the expansion width.

EP 653 319 teaches to provide a wider expansion by implementing a special design of the pleat in the corner zone by forming a pocket.

The published application DE-OS 26 17 931 also teaches to dispose what is termed a double pleat between two normal pleats in an effort to increase the expansion, in the corner zone in particular.

It has been found though that, more specifically with low floor vehicles and with vehicles that are to travel around sharp curves, these measures do not suffice to provide the required expansion width.

10 **BRIEF DESCRIPTION OF THE INVENTION**

It is therefore the object of the invention to provide an expansion or a concertina bellows, more specifically for a low floor vehicle, that permits the vehicle to travel around sharp curves by increasing the expansion of the bellows in the corner zone thereof.

In accordance with the invention, the solution to this object is achieved in that, for the purpose of increasing the expansion of the bellows in the corner zone, the corrugation or pleat in the corner zone of the bellows is comprised of a pleat or corrugation insert unit having a plurality of pleats or corrugations, with said pleat or corrugation insert unit tapering in the region of the upper end thereof toward the vertex of the pleat or corrugation where it is connected to said pleat or corrugation.

Accordingly, the invention is based on the idea that an existing pleat or corrugation is to be divided into a plurality of pleats or corrugations forming a unit for the purpose of achieving the desired expansion in the corner zone, i.e., in the transition zone between the side wall and the bottom or the ceiling region, by providing one single pleat, which is called the main pleat or corrugation, with this plurality of pleats or corrugations.

Advantageous characteristics and embodiments of the invention will become apparent from the subclaims.

There is more specifically provided that the pleat insert or corrugation insert unit is made in one piece, e.g., is injection molded polyurethane. By injection moulding such an insert unit, it is achieved that a plurality of pleats or corrugations that are to converge at a point, namely at the point of transition to the vertex of the main pleat or

corrugation receiving said unit, will not form too thick a bulk. This would more specifically be the case if the various pleats or corrugations of this separate unit were sewn together in the manner also known from bellows manufacturing.

According to another feature of the invention, the pleats or corrugations of the pleat or corrugation insert units in the transition zone toward the bottom of the bellows have a height corresponding to the height of the pleat or corrugation which receives the pleat or corrugation insert unit. As a result, the height of all of the pleats or corrugations in the region of the bottom of the bellows is substantially the same, with the pleats or corrugations generally becoming increasingly flat toward the center of the transition and possibly tapering into a fabric forming the bottom of the bellows.

According to another advantageous feature of the invention there is provided that in the region of the transition to the vertex of the receiving pleat or corrugation the pleat or corrugation insert unit tapers toward the vertex of the pleat or corrugation to approximately the thickness of the pleat or corrugation material. It will be obvious therefrom that the pleat or corrugation insert unit has the appearance of a banana in cross section. In order to stabilize the very pleat of the pleat insert element, there may be provided a border member at the vertex of the pleats of the pleat insert unit, said border member being disposed in the form of a frame for example. The same applies to the main pleat.

The invention is explained in more detail by way of example only with reference to the drawing.

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#### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

Fig. 1 is a perspective detail view of the corner zone of a bellows in the transition zone between the side wall and the bottom of the bellows;

35 Fig. 2 is a side view of a pleat insert unit only.

#### DETAILED DESCRIPTION OF THE INVENTION

A bellows is part of a connection between two hinge-linked vehicles. The bellows, whether implemented as an expansion bellows or as a concertina bellows, surrounds the transition

zone between these two vehicles or vehicle sections like a closed tunnel having a substantially rectangular cross-section with rounded corners.

The illustration according to Fig. 1 shows, as already explained, a detail of the corner zone of a concertina bellows in the transition zone between the side wall and the bottom. The drawing shows a portion of a concertina bellows, it should however be noted here that an expansion bellows can be provided with a corrugation insert unit in a similar way. The detail of a concertina bellows, which is labelled at 1 in Fig. 1, shows the pleat designed at 10. The pleat 10 (main pleat) has a vertex 11, said vertex 11 opening in the transition zone between the side wall and the bottom to receive the pleat insert unit 20 of the invention. In the instant case, said pleat insert unit 20 is comprised of three pleat inserts 21, 22, 23, the outer sides 21a and 23a of the pleat inserts being connected to the sides 10a or 10b of the main pleat 10. Said pleat inserts 21, 22, 23 of the pleat insert unit converge so to speak at a point in the vertex 11 of the main pleat 10 (arrow 13).

Fig. 2 is a cross sectional view of the pleat insert unit; it can more specifically be seen that this pleat insert unit looks like a banana. In the bottom region, the schematically illustrated bellows bottom 30 joins the various pleat inserts or pleats (Fig. 1). The bellows bottom 30 increasingly flattens toward the central axis of the bellows, meaning the pleats gradually decrease in height until they finally, in the extreme case, taper in a fabric in order to achieve maximum ground clearance.

The main pleat further shows what will be termed a border frame that bears the reference numeral 16. Said border frame 16 serves to stabilize the pleat. On their upper but also on their lower side the pleats 21, 22, 23 of the pleat insert unit can also be provided with corresponding border frames 25 which, for clarity, have been merely outlined.

It has been found that, with the main pleat 10 having a height H1 of 120 mm and with the pleat 10 having a height H2 in the bottom region and with the pleat inserts of the pleat insert unit consisting of three pleat inserts 21, 22, 23 having a height of 40 mm each, a maximum expansion of 165 mm

can be achieved, said expansion corresponding exactly to the dimension provided by the main pleat 10. The maximum expansion of 165 mm could still be increased if the border frames 16, 25 were dispensed with.